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CANADA

THE PATENT OFFICE

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Process for Making Shot

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This invention relates to the manufacture of ammunition and, more particularly, to a method of manufacturing ferrous shot.

In the commonly used drop-forming method of making iron shot, the globules of molten metal are allowed to fall in air where the globules assume a spherical shape before they fall into a tank of water, while still intensely hot, where they become solidified. During the exposure to air and water vapor, the surfaces of the globules are subjected to oxidation. Iron shot coated with iron oxide cannot be used for some industrial applications and, specially, a coating of oxide is objectionable because of its abrasiveness when the shot is intended for use as ammunition.

It is, therefore, an object of this invention to provide an improved method overcoming the above-noted disadvantages.

A principal object of the invention is to produce iron shot, the surface of which is bright and free of oxide. Other objects will be apparent from the following description.

In accordance with this invention, ferrous shot with bright oxide-free surface is produced by dropping globules of molten metal through air for a limited distance and catching the globules in a body of quench liquid comprising water and an organic antioxidant which exerts a partial vapor pressure from water solutions such that the vapor, produced when the quench mixture is contacted by the molten metal globules, contains both water and the antioxidant and/or its decomposition products. In particular, it was found that, when water soluble alcohols, ketones, aldehydes, esters, or organic acids are contained in the quench water in amounts sufficient to prevent the formation of a film of oxide on the falling shot, but not in such a large quantity as to cause mal-formation of the shot, bright spherical pellets are produced.

In particular, a body of quench liquid comprising water and approximately 1.5% to 5% of a mono-hydric water miscible alcohol produces the desired result. It is to be understood that all percent figures given herein are stated in percent by weight.

The shot may be initially formed by the procedure disclosed in U.S. patent 2,544,678, or in any other suitable way.

The invention is further illustrated, but is not intended to be limited, by the following examples:

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Example I

An aqueous mixture containing 5% methyl alcohol was used as a quench bath for molten iron pellets. After falling about 26 inches through air and 3 feet in the quench bath, the solidified shot was collected and found to have a bright, oxide-free surface. Few irregularities of spherical configuration were observed. Bright iron pellets have also been produced using a fall of 32 inches in air and an aqueous quench bath containing 10% methyl alcohol, but, in contrast to results obtained with 5% alcohol, the pellets were found to contain appreciable numbers of gas cavities.

Example II

Molten iron pellets were dropped about 26 inches through air into a quench bath consisting of water and various percents of ethyl alcohol from 1.8% to 5%. A 5% solution of ethyl alcohol produced a bright shot, but some of the shot collected from the quench bath contained gas cavities. It was observed that, when the alcohol content was reduced to 1.8%, a normal yield of spherical shot was obtained, but the surface of the solidified shot was only partially free of oxide. Between the limits of 2% and 4.8% ethanol, the results were satisfactory.

Other Examples

Bright surfaces without mal-formation were achieved when the molten metal particles were quenched in a bath consisting of water to which had been added any of the alternative organic anti-oxidants as indicated in the following table:

Name	Percentage
1. Acetone	3 to 5
2. n Butanol	2
3. Isopropanol	2
4. Methyl ethyl ketone	2 to 2
5. Paraldehyde	3
6. Tertiary butyl alcohol	2
7. Acetic acid	5 to 10
8. Ethyl acetate	1

It has been shown in the examples that ferrous shot dropped through air with limited exposure thereto and solidified by quenching in a bath of water and an organic antioxidant, in accordance with this invention, are substantially free of surface oxide and are composed of solid metal of

spherical configuration. Although the preferred antioxidant content of the quench bath is from 1·5% to 5%, it is to be understood that, when the path of the falling shot occurs in a confined space over the quench bath, less antioxidant may be needed to produce a bright surface than when the shot is subjected to that exposure to air encountered in a fall of 36 inches or less. It is to be expected that pellets subjected to strongly oxidizing conditions while molten may require so great an amount of alcohol to produce a bright surface as to produce irregular pellets instead of shot of spherical configuration.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In the method of making ferrous shot, the step comprising dropping globules of molten metal into a quench bath composed of water containing an organic antioxidant which is water-soluble and which exerts a partial vapor pressure from water solutions, said antioxidant constituting not more than ten per cent by weight of the quench bath but at least sufficient to inhibit oxidation of the surface of said globules and at most less than sufficient to produce cavities in the globules. 20

2. In the method of making ferrous shot having a bright oxide-free surface, the step comprising dropping globules of molten metal into a body of 25

water containing an organic antioxidant selected from a group consisting of methyl alcohol, ethyl alcohol, acetone, butanol, isopropanol, methyl ethyl ketone, paraldehyde, tertiary butyl alcohol, acetic acid, and ethyl acetate, said antioxidant not exceeding ten per cent by weight of the water but being in an amount sufficient to deoxidize the surface of the shot and at most less than sufficient to produce cavities in the globules.

3. In the method of making ferrous shot wherein globules of molten iron are dropped through an atmosphere containing oxygen and collected in an aqueous quench bath, the improvement which comprises, said quench bath containing a monohydric alkyl alcohol in an amount sufficient to deoxidize the surface of the shot but not more than five per cent by weight of said quench bath and at most less than sufficient to produce cavities in the globules. 10 15

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